IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
Before the Board of Patent Appeals and Interferences

In re Patent Application of: HOLLIER et al
Serial No. 09/889,041
Filed: July 11, 2001
Title: ANALYSIS OF VIDEO SIGNAL QUALITY

Atty Dkt. CC-36-1459
C# M#
TC/A.U.: 2625
Examiner: S. Perungavoor
Date: August 28, 2007

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

☐ **Correspondence Address Indication Form Attached.**

☐ **NOTICE OF APPEAL**
Applicant hereby **appeals** to the Board of Patent Appeals and Interferences from the last decision of the Examiner twice/finally rejecting applicant's claim(s). $500.00 (1401)/$250.00 (2401) $ 0.00

☒ An appeal **BRIEF** is attached in the pending appeal of the above-identified application $500.00 (1402)/$250.00 (2402) $ 500.00

☐ Credit for fees paid in prior appeal without decision on merits -$ ( )

☐ A reply brief is attached. **(no fee)**

☐ Pre-Appeal Brief Request for Review form attached.

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One Month Extension $120.00 (1251)/$60.00 (2251)
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☐ "Small entity" statement attached.

Less month extension previously paid on -$( )

TOTAL FEE ENCLOSED $ 500.00

Any future submission requiring an extension of time is hereby stated to include a petition for such time extension. The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our **Account No. 14-1140.** A duplicate copy of this sheet is attached.

901 North Glebe Road, 11th Floor
Arlington, Virginia 22203-1808
Telephone: (703) 816-4000
Facsimile: (703) 816-4100
CC:lmr

NIXON & VANDERHYE P.C.
By Atty: Chris Comuntzis, Reg. No. 31,097

Signature:

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Patent Application of

HOLLIER et al — Atty. Ref.: 36-1459

Serial No. 09/889,041 — TC/A.U.: 2625

Filed: July 11, 2001 — Examiner: S. Perungavoor

For: ANALYSIS OF VIDEO SIGNAL QUALITY

* *

August 28, 2007

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Sir:

Appellant hereby **appeals** to the Board of Patent Appeals and Interferences from the last decision of the Examiner.

TABLE OF CONTENTS

(I) REAL PARTY IN INTEREST

The real party in interest is British Telecommunication, plc, a corporation of the country of England.

(II) RELATED APPEALS AND INTERFERENCES

The appellant, the undersigned, and the assignee are not aware of any related appeals, interferences, or judicial proceedings (past or present), which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

(III) STATUS OF CLAIMS

Claims 1-20 are pending and have been rejected. More particularly claims 1-7 and 12-18 have been rejected as anticipated under 35 U.S.C. § 102 by a document entitled "Committee T1 Performance Standards Contribution: Objective and Subjective Measures of MPEG Video Quality" (hereinafter "T1"). Claims 8, 19 and 20 have been rejected as obvious under 35 U.S.C. § 103(a) over T1 in view of Western et al., a document entitled "Perceptual Image Quality Based on a Multiple Channel HVS Model" (hereinafter "Western"). Claims 9 and 10 have been rejected as obvious under 35 U.S.C. § 103(a) over T1 in view of Western and further in view of Zhou (U.S. Patent 5,550,580). Claim 11 has been rejected as obvious under 35 U.S.C. § 103(a) over T1 in view of Western and further in view of Bhaskaran et al. (hereinafter "Bhaskaran") an article entitled "Text and Image Sharpening of Scanned Images in the JPEG Domain." No claims have been substantively allowed. All of rejected claims 1-20 are being appealed.

(IV) STATUS OF AMENDMENTS

No amendments have been filed since the date of the Final Rejection.

(V) SUMMARY OF CLAIMED SUBJECT MATTER

The inventions of the claims relate to methods and apparatuses for the analysis of the quality of video signals. A listing of each independent claim, each dependent claim argued separately and each claim having means plus function language is provided below including exemplary references to page and line numbers of specification.

1. A method of measuring the differences between a first video signal and a second video signal, said method comprising:

analyzing information content of each video signal to identify perceptually relevant boundaries of video images depicted therein [Fig. 1, p. 6, lines 16-17 and line 21 to p. 9, line 8];

comparing boundaries so defined in the first signal with those in the second signal, the comparison including determination of the extent to which the properties of boundaries defined in the first image are preserved in the second image [Fig. 3, p. 6, lines 17-19, p. 9, line 9 to p. 12, line 14]; and

generating an output indicative of perceptual difference between the first and second signals [Fig. 3, p. 12, line 15 to p. 14, line 5].

2. A method as in Claim 1, in which the information content is analyzed for a plurality of boundary-identifying characteristics, and the properties of boundaries on which the comparison is based include characteristics by which such boundaries are defined in each of the signals [Fig. 1, p. 4, lines 7-21].

3. A method as in claim 2, wherein the characteristics include the presence of edges [Fig. 1, p. 4, lines 7-12].

4. A method as in claim 2, wherein the characteristics include the presence of disparities between frames of the same signal [Fig. 1, p. 4, lines 22-30].

5. A method as in claim 2, wherein the characteristics include changes in at least one of the properties of: luminance, color or texture [Fig. 1, p. 4, lines 7-12, p. 5, line 30 to p. 6, line 2].

6. A method as in claims 1, in which the comparison includes a comparison of perceptibility of corresponding boundaries identified in the first and second signals [Fig. 1, p. 5, lines 7-14].

7. A method as in claim 1, in which the comparison of the images includes: identification of principal elements in each image [[Fig. 1, p. 5, lines 17-21], and compensation for differences in relative positions of said principal elements [Fig. 1, p. 5, lines 21-26].

8. A method as in claim 1, in which the analysis includes identification of perceptually significant image features, and the output indicative of perceptual difference between the first and second signals is weighted according to cognitive relevance of such image features [Fig. 1, p. 5, line 27 to p. 6, line 6].

9. A method as in claim 8, in which perceptually significant image features are those characteristic of the human face [Fig. 1, p. 5, lines 31-33].

10. A method as in claim 9, in which weighting is applied to the output according to significance of the feature in providing visual cues to speech [Fig. 1, p. 5, line 31 to p. 6, line 3].

11. A method as in claim 8, in which perceptually significant image features are those by which individual text characters are distinguished [Fig. 1, p. 6, lines 4-6].

12. Apparatus for measuring the differences between a first video signal and a second video signal, said apparatus comprising:

analysis means for processing information content of each video signal to identify perceptually relevant boundaries of video images depicted therein [Fig. 1, Reference Numerals 11-16, p. 6, lines 16-17 and 21 to p. 9, line 8];

comparison means for comparing boundaries so defined in the first signal with those in the second signal, the comparison including determination of the extent to which properties of boundaries defined in the first image are preserved in the second image [Fig. 3, Reference Numerals 16, 16d, 31, 32, 32d and 33-37, p. 4, line 7 to p. 6, line 6, p. 6, lines 17-19, p. 9, line 9 to p. 12, line 14]: and

means for generating an output indicative of perceptual difference between the first and second signals [Fig. 3, Reference Numerals 37, 38, p. 12, line 15 to p. 14, line 5].

13. Apparatus as in Claim 12, wherein:

the analysis means is arranged to analyze information content in the signals for a plurality of boundary-identifying characteristics [Fig. 1, Reference numerals 11-16, p. 4, line 7 to p. 6, line 6, p. 6, lines 17-19, p. 9, line 9 to p. 12, line 14], and

the comparison means is arranged to compare characteristics by which such boundaries are defined in each of the signals [Fig. 3, Reference Numerals 37, 38, p. 12, line 15 to p. 14, line 5].

14. Apparatus as in claim 13, wherein the analysis means includes means to identify the presence of edges [Fig. 1, Reference Numerals 11-16, p. 4, lines 7-12].

15. Apparatus as in claim 13, wherein the analysis means includes means to identify the presence of disparities between frames of the same signal [Fig. 1, Reference Numerals 11-16, p. 4, line 13 to p. 6, line 6].

16. Apparatus as in claim 13, wherein the analysis means includes means to identify differences in at least one of the properties of: luminance, color or texture [Fig. 1, Reference Numerals 11-16, p. 4, line 7 to p. 5, line 2].

17. Apparatus as in claim 12, in which the comparison means includes means for determining perceptibility of the boundaries identified in the first and second signals [Fig. 3, Reference Numerals 33-35, p. 12, line 25 to p. 13, line 6].

18. Apparatus as in claim 12, in which the comparison means includes image matching means for identifying principal elements in each image and translation means for effecting translation of one image to compensate for differences in relative positions of such elements in the first and second images [Fig. 3, Reference Numerals 33-35, p. 13, lines 3-6].

19. Apparatus as in claim 12, in which the comparison means includes weighting means for identifying perceptually significant image features, and weighting

the output according to cognitive relevance of such image features [Fig. 3, Reference Numeral 36, p. 13, lines 7-17].

20. Apparatus as in claim 12, further comprising:

visual stage means for processing original input signals to emulate the response of the human visual system and to generate modified input signals for input to the analysis means [Fig. 1, Reference Numeral 12, p. 7, lines 6-13].

(VI) GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether claims 1-7 and 12-18 are anticipated under 35 U.S.C. § 102 by a document entitled "Committee T1 Performance Standards Contribution: Objective and Subjective Measures of MPEG Video Quality" (hereinafter "T1").

Whether claims 8, 19 and 20 would have been obvious under 35 U.S.C. §103(a) over T1 in view of Western et al. (hereinafter "Western") a document entitled "Perceptual Image Quality Based on a Multiple Channel HVS Model."

Whether claims 9 and 10 would have been obvious under 35 U.S.C. § 103(a) over T1 in view of western and further in view of Zhou (U.S. Patent 5,550, 580).

Whether claim 11 would have been obvious under 35 U.S.C. § 103(a) over T1 in view of Western and further in view of Bhaskaran et al. (hereinafter "Bhaskaran) an article entitled "Text and Image Sharpening of Scanned Images in the JPEG Domain."

(VII) ARGUMENT

The Examiner has improperly rejected claims 1-7 and 12-18 under 35 U.S.C. §102 as being anticipated by the T1 document, because the cited reference does not teach or suggest an element of independent claims 1 and 12. More particularly, the T1 document does not teach or suggest "analyzing information content of each video signal to identify perceptually relevant boundaries of video images depicted therein" as required by independent method claim 1. Nor does the T1 document teach or suggest "analyzing means for processing information content of each video signal to identify perceptually relevant boundaries of video images depicted therein" as required by independent apparatus claim 12.

Thus, each of the present claims requires an analysis process or apparatus that identifies the information content of a video signal to identify the perceptually relevant boundaries of the video images depicted therein. The Examiner erroneously equates this analysis process or apparatus to identification of the edges by the prior art T1 document but, as is described in detail in the present application, edges and boundaries are not the same thing and, in many images, edges are not perceptually relevant. For example, the present specification states at the end of page 4 to the top of page 5 (also see the examples where the edges are not the most significant boundaries as illustrated, for example, in Figure 7):

> The basis for the invention is that elements present in the image are not of equal importance. An error will be more perceptible if it disrupts the shape of one of the essential features of the image. For example, a distortion present on an edge in the middle of a textured region will be less perceptible than the same error on the independent edge. This is because an edge forming part of a texture carries less information than an independent edge, as described by Ran, X., and Favardin, N., *"A Perceptually Motivated Three-Component Image Model – Part II: Application to*

> *Image Compression", IEEE Transactions on Image Processing, Vol. 4, No. 4, pp. 713-724, April 1995.* If, however, a textured area defines a boundary, an error that changes the properties of the texture throughout the textured area can be as important as an error on an independent edge, if the error causes the textured characteristics of the area to be lost. The present invention examines the cognitive relevance of each boundary, and the extent to which this relevance is preserved.

See Present Specification at page 4, line 22 to page 5, line 2. The identification of the relevance of a particular boundary whether defined by a simple edge as in T1, or by a change of texture, color or any other characteristic mentioned in the specification is well documented throughout the present specification. See, in addition to the above cited passage, *inter alia*, the present specification at page 4, lines 7-21; page 5, line 3 to page 6, line 6; and page 6, line 15 to page 9, line 8.

Appellant's method and apparatus are concerned with making use of the relative relevance of such boundaries, and the degree to which they are preserved n the "degraded" image, as a basis for measuring the perceived quality of the signal that would be perceived by a user. Methods of identification of such boundaries are discussed in detail throughout the present specification, but independent claims 1 and 12 relate to the generic concept, however they are identified. The cited T1 prior art, on the other hand, identifies <u>all edges</u>, whether or not perceptually relevant and, thus, does not teach or suggest the "analyzing" feature of Appellant's invention.

In support of the rejection, the Examiner cites to *In Re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997), stating:

> The court held that the PTO is not required in the course of prosecution, to interpret claims in applications in the same manner as a court would interpret claims in an infringement suit. Rather, the "PTO applies to verbiage of the proposed claims the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of

> ordinary skill in the art, taking into account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in applicant's specification." (Underlining emphasis supplied.)

See Final Office Action at pages 2-3. However, the Examiner in applying *Morris* has failed to take into account the above underlined portion of the citation wherein the Federal Circuit instructs that, in interpreting the claims, the PTO must take into account "whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in applicant's specification." This the Examiner has failed to do by erroneously equating Appellant's defined claim term "perceptually relevant boundaries" with the T1 term of "edges" in contradiction to the present specification.

More particularly, the term "perceptually relevant boundaries" is defined in the present specification:

> The boundaries between the main elements of an image may be identified by any measurable property used by the human perceptual system to distinguish between such elements. These may include, but are not limited to, colour, luminance, so-called "hard" edges (a narrow line of contrasting colour or luminance defining an outline or other boundary, such a line being identifiable in image analysis as a region of high spatial frequency), and others which will be discussed later.
>
> The properties of the boundaries on which the comparison is based include the characteristics by which such boundaries are defined. In particular, if a boundary is defined by a given characteristic, and that characteristic is lost in the degraded image, the degree of perceived degradation of the image element is dependant on how perceptually significant the original boundary was. If the element defined by the boundary can nevertheless be identified in the degraded image by means of a boundary defined by another characteristic, the comparison also takes account of how perceptually significant such a replacement boundary is, and how closely its position corresponds with the original, lost, boundary.

See present specification at page 4, lines 7-21. As further explained in the present specification Appellant's inventions are predicated on the basis that not all elements of the image are of equal importance.

> The basis for the invention is that elements present in the image are not of equal importance. An error will be more perceptible if it disrupts the shape of one of the essential features of the image. For example, a distortion present on an edge in the middle of a textured region will be less perceptible than the same error on an independent edge. This is because an edge forming part of a texture carries less information than an independent edge, as described by Ran, X., and Favardin, N., *"A Perceptually Motivated Three-Component Image Model - Part II: Application to Image Compression". IEEE Transactions on Image Processing, Vol. 4, No. 4, pp. 713-724, Apr11 1995.* If, however, a textured area defines a boundary, an error that changes the properties of the texture throughout the textured area can be as important as an error on an independent edge, if the error causes the textured characteristics of the area to be lost. The present invention examines the cognitive relevance of each boundary, and the extent to which this relevance is preserved.
>
> The process identifies the elements of greatest perceptual relevance, that is the boundaries between the principal elements of the image. Small variations in a property within the regions defined by the boundaries are of less relevance than errors that cause the boundary to change its shape.

See present specification at page 4, line 22 to page 5, line 6. Thus, the claimed inventions patentably define over the teachings of the T1 reference by "analyzing the information content of each video signal to identify the perceptually relevant boundaries of the video images" and disregarding perceptually unimportant differences by only "comparing boundaries so defined" as relevant. See independent claims 1 and 12 and the present specification at page 5, lines 17-26.

Moreover, dependent claims 2-6 and 13-18, respectively, require further limitations on the information content analyzed or compared in independent claims 1

and 12. For example, dependent claims 5 and 16 further require that boundary identifying characteristics, determined by analyzing the information content of each video signal, include "changes in at least one of the properties of: luminance, color or texture." The T1 reference simply does not teach or suggest this further limitation, and the Examiner's citation to page 10 and paragraphs 3 and 4 of the cited reference does not provide any such teaching. In fact, nowhere does the T1 reference disclose analyzing boundary characteristics on the basis of luminance, color or texture to identify perceptually relevant boundaries of video images, as required by dependent clams 5 and 16.

Accordingly, all of claims 1-7 and 12-18 are believed to patentably define over the T1 reference which does not teach or suggest "analyzing information content of each video signal to identify perceptually relevant boundaries of video images depicted therein" let alone "comparing boundaries so defined in the first signal with those in the second signal" substantially as required in each of the rejected claims.

The Examiner has also improperly rejected claims 8, 19 and 20 under 35 USC §103(a) as being unpatentable over T1 in view of Western et al. The Examiner has cited Western et al. merely for disclosing the further limitations in claims 8, 19 and 20. Accordingly, it is clear that the cited Western et al. reference also does not solve the deficiency noted above with respect to the T1 reference. More particularly, Western et al. does not teach or suggest "analyzing the information content of each video signal to identify perceptually relevant boundaries of the video images depicted therein." Accordingly, claims 8, 19 and 20 are also believed to patentably define over the cited references taken either singly or in combination.

The Examiner has also improperly rejected claims 9 and 10 under 35 USC §103(a) as being unpatentable over T1 in view of Western et al. and further in view of Zhou. Since Zhou also does not solve the deficiency noted above with respect to the T1 reference and Western et al., these claims are also believed to patentably define over the cited references taken either singly or in combination.

Finally, the Examiner has also improperly rejected claim 11 under 35 U.S.C. § 103(a) as being unpatentable over T1 in view of Western et al. and further in view of Bhaskaran. Since Bhaskaran does not solve the deficiency noted above with respect to the T1 reference and Western et al., claim 11 is believed to patentably define over the cited references taken singly or in combination.

CONCLUSION

In conclusion it is believed that the application is in clear condition for allowance; therefore, early reversal of the Final Rejection and passage of the subject application to issue are earnestly solicited.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: _____
Chris Comuntzis
Reg. No. 31,097

CC:lmr
901 North Glebe Road, 11th Floor
Arlington, VA 22203-1808
Telephone: (703) 816-4000
Facsimile: (703) 816-4100

(VIII) CLAIMS APPENDIX

1. A method of measuring the differences between a first video signal and a second video signal, said method comprising:

analyzing information content of each video signal to identify perceptually relevant boundaries of video images depicted therein;

comparing boundaries so defined in the first signal with those in the second signal, the comparison including determination of the extent to which the properties of boundaries defined in the first image are preserved in the second image; and

generating an output indicative of perceptual difference between the first and second signals.

2. A method as in Claim 1, in which the information content is analyzed for a plurality of boundary-identifying characteristics, and the properties of boundaries on which the comparison is based include characteristics by which such boundaries are defined in each of the signals.

3. A method as in claim 2, wherein the characteristics include the presence of edges.

4. A method as in claim 2, wherein the characteristics include the presence of disparities between frames of the same signal.

5. A method as in claim 2, wherein the characteristics include changes in at least one of the properties of: luminance, color or texture.

6. A method as in claims 1, in which the comparison includes a comparison of perceptibility of corresponding boundaries identified in the first and second signals.

7. A method as in claim 1, in which the comparison of the images includes:

identification of principal elements in each image, and

compensation for differences in relative positions of said principal elements.

8. A method as in claim 1, in which the analysis includes identification of perceptually significant image features, and the output indicative of perceptual difference between the first and second signals is weighted according to cognitive relevance of such image features.

9. A method as in claim 8, in which perceptually significant image features are those characteristic of the human face.

10. A method as in claim 9, in which weighting is applied to the output according to significance of the feature in providing visual cues to speech.

11. A method as in claim 8, in which perceptually significant image features are those by which individual text characters are distinguished.

12. Apparatus for measuring the differences between a first video signal and a second video signal, said apparatus comprising:

analysis means for processing information content of each video signal to identify perceptually relevant boundaries of video images depicted therein;

comparison means for comparing boundaries so defined in the first signal with those in the second signal, the comparison including determination of the extent to

which properties of boundaries defined in the first image are preserved in the second image: and

means for generating an output indicative of perceptual difference between the first and second signals.

13. Apparatus as in Claim 12, wherein:

the analysis means is arranged to analyze information content in the signals for a plurality of boundary-identifying characteristics, and

the comparison means is arranged to compare characteristics by which such boundaries are defined in each of the signals.

14. Apparatus as in claim 13, wherein the analysis means includes means to identify the presence of edges.

15. Apparatus as in claim 13, wherein the analysis means includes means to identify the presence of disparities between frames of the same signal.

16. Apparatus as in claim 13, wherein the analysis means includes means to identify differences in at least one of the properties of: luminance, color or texture.

17. Apparatus as in claim 12, in which the comparison means includes means for determining perceptibility of the boundaries identified in the first and second signals.

18. Apparatus as in claim 12, in which the comparison means includes image matching means for identifying principal elements in each image and translation means for effecting translation of one image to compensate for differences in relative positions of such elements in the first and second images.

19. Apparatus as in claim 12, in which the comparison means includes weighting means for identifying perceptually significant image features, and weighting the output according to cognitive relevance of such image features.

20. Apparatus as in claim 12, further comprising:

visual stage means for processing original input signals to emulate the response of the human visual system and to generate modified input signals for input to the analysis means.

(IX) EVIDENCE APPENDIX

None.

(X) RELATED PROCEEDINGS APPENDIX

None.